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There is more to the Teaching and Learning of Mathematics than the use of Local Languages: Mathematics Teacher Practices

Nancy Chitera [*]
The University of Malawi

Dun Kasoka [**]
The University of Malawi

E. Thomo[***]
The University of Malawi

Abstract

In this article, we present a discussion about the type of mathematical discourse that is being produced in classrooms where the language of learning and teaching is local languages. We also further explore the tensions in the mathematical discourse being produced. The study sample was 4 mathematics teachers from a semi-urban primary school in Malawi. The methods of data collection included classroom observations, pre-observation focus group discussions and reflective interviews. The results show that even though both students and teachers were able to communicate freely in local languages in the mathematics classroom, the mathematical discourse that came was distorted. This is mainly caused by lack of a well-developed mathematical discourse in local languages, which in turn takes away the confidence of mathematics teachers in the classroom. As a result, the mathematics classrooms are still being characterized by teachers not being creative, use of word by word from books, focus more on procedural than conceptual and thus teacher centered is still dominant in these classrooms. Furthermore, it is found that there are tensions between the formal and informal mathematical language in local languages. These results in turn have promoted a more in-depth understanding to the teaching and learning of mathematics when local language is the language of learning and teaching. Therefore, this article argues for a well-balanced approach when it comes to teaching and learning of mathematics rather than just focusing on the use of local languages.

Keywords*: mathematical discourse, language of learning and teaching, local languages, mathematics teachers, mathematics classroom, formal and informal mathematical language.*

[*] Nancy Chitera, The University of Malawi, the Polytechnic, P/Bag 303, Chichiri, Blantyre 3
E-mail: *nchitera@poly.ac.mw*

[**] Dun Kasoka, The University of Malawi, the Polytechnic, P/Bag 303, Chichiri, Blantyre 3
E-mail: *nchitera@poly.ac.mw*

[***] E Thomo, The University of Malawi, the Polytechnic, P/Bag 303, Chichiri, Blantyre 3
E-mail: *nchitera@poly.ac.mw*

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Introduction

In most African countries, there has been a shift in Language in Education Policies (LiEP). Literature indicates that before African countries received their independence from their colonies, they adopted the colonial languages such as English, French, and Portuguese, as the Language of Learning and Teaching (LoLT) in their LiEP. Because of the challenges that both learners and teachers were facing when teaching in these colonial languages, GTZ report (1995) indicates that African countries agreed to introduce the use of local languages as the LoLT in the first few years of schooling. In her paper, Chitera (2010) found that even though the African countries adopted the use of local languages, there have been no tangible reforms in the way teachers are trained in order to equip them as they implement these new policies. As a result there are a number of implementation challenges (see Chitera, 2010, Chitera et al, 2012) in the implementation of these policies.

Gorgorio & Plannas (2001) argues that language and communication are essential elements of language and learning [in particular] mathematics. This is so, because language is a communication tool and facilitates transmission (Ni Riordain, 2013). This implies that language can be a barrier or beneficial to the students depending on how it is used. Studies related to LoLT issues in post-colonial Africa suggest that the use of colonial languages such as as LoLT created teaching and learning problems in African schools (GTZ, 2005; Poth, 1980). Classroom observations conducted in several countries in Africa (For example, Benin, Burkina Faso, Guinea-Bissau, Mali, Mozambique, Niger, South Africa, Togo, Tanzania, Ethiopia, Ghana, and Botswana) revealed that the use of colonial languages made teachers to use traditional and teacher-centered teaching methods (Alidou & Brock-Utne, 2005). An analysis of classroom observations conducted in Tanzania and Malawi, for example, revealed that there were problems in communication between teachers and learners in a classroom where the language, which was foreign to both, was used as LoLT (Alidou & Brock-Utne, 2005). Most learners did not grasp and develop the mathematics register.

Apart from problems of communication in schools, Ni Riordain & O` Donoghue (2008) argues that competency in the language of which the teaching of mathematics is done is more significant to the mathematics performance. In their study, the authors found that students who were not competent in the language where mathematics was taught and carried through, which was English, performed very poor as compared to those who were competent in English. This shows that the language that students initially learn mathematics through will provide the foundations to be built upon and developed within that language.

According to Ni Riordain & O` Donoghue (2008) students who are competent in both the local language and English performes much better than those who are competent in English only and those who are not competent in both local language and English performs poorly than their friends. These arguments are also echoed by Barwell (2003); Clarkson, (2007) and Williams (2002). These authors indicate that there is a positive correlation and cognitive benefits from learning through the second language. The reason given by Ni Riordain & McCluckey, (2012) is that those competent in English have academic language proficiency in the language as well as in the English mathematics register.

Even though there are benefits with the use of second language, Setati & Adler (2000), and Barton et al (2005) argues that students who are not fluent in the language of learning and teaching they normally underachieve in mathematics. In most Malawian schools (especially government/public schools) English is the second language of both the students and teachers and most do not have the competency in English. With this in mind, and, if Ni Riordain & O` Donoghue (2008) results are to go by, then Malawian students' performance in mathematics will be lower. Setati & Planas (2012), however give a caution that when comparing mathematics processing in different languages across different cultures, number of factors such as social, political and pedagogical differences have to be considered. Even though such is the case, the literature shows the importance of balancing the language of learning and teaching and local languages because focusing on one puts the students at a disadvantaged.

In trying to help learners participate in classroom activities and improve students' performance, most teachers use code-switching (Adler, 2001) between the learners' home language and the official LoLT, a practice which was not allowed, because the LoLT in classrooms was English. Alidou & Brock-Utne (2005) reported that teachers were using coercive measures to force learners to speak in the foreign language. The learners were asked to stand in the class until the lesson was over and they had to wear "a symbol" around their necks indicating their incompetence. This was done to force learners to speak in the LoLT, which was not their home language.

In most African schools, in particular Malawi, a colonial language is the second or third language for learners. This situation is gravitated with the fact that there are no resources and support

to those using the second language as language of learning and teaching. As the result Ni Riordain (2007) explains that the transition for students becomes very difficult, students feel isolated and confused. She argues that schools need to provide resources necessary for students to cope with the demands of the use of second language. As a result of the challenges that teachers and learners experience when a language that is not their home language is used as LoLT, and after considering the benefits of learning in one's language, other organizations, such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the German Agency for Technical Cooperation (GTZ) have been in the forefront in promoting the use of home languages in African classrooms (GTZ, 2005). As a result there has been a shift from the use of colonial languages to home languages as LoLT for the first two to four years of schooling in LiEP in some countries such as Kenya, Malawi, Burkina Faso, Mozambique and Mali due to the initiative of these two organizations. For example, in Malawi English is the official language. It is also the LoLT in education. As such, learners learn English as a subject from grades 1 to 4, and from Grade 5 it takes over from the local language as the LoLT and it continues to be the second language throughout the learner's learning period up to tertiary level.

According to Cummins (1981), Tikunoff (1985), and Wong-Fillmore & Valadez (1986), the use of learners' home language(s) has benefits on school progress particularly when it is used in the explanation of concepts and for clarification. The argument here is that learners learn best in the language that they understand better, and more than this, learning in a first language is beneficial for the acquisition of an additional language.

The above literature reveals that dominance in the language of learning and teaching is more desirable than dominance in local languages which is not the language of learning and teaching. It is also seen that being good at your first language is an important requirement for learning other languages. The question is, what about the learning of mathematics? Literature supports that teaching and learning mathematics in a language which is not your home language is difficult, with the introduction of the local languages as LoLT in the first four years of learning, is teaching and learning of mathematics easier than before?

These studies

Mathematical language

Literature shows that there are many different relationships that can be highlighted between mathematics and language, Pimm (1991). Mathematics has its own register (Halliday, 1975; Pirie, 1998), rules, grammar, syntax, vocabulary, word order, synonyms, negations, conventions, abbreviations, sentence structure, and paragraph structure (Esty & Teppo, 1994, p. 1). Halliday (1975) specifies the notion of register as 'a set of meanings that is appropriate to a particular function of language, together with the words and structures which express these meanings'. Lee & Fradd (1998) explain that appropriate use of key mathematical terminology is an indicator of the precision and sophistication of understanding. Therefore, part of learning mathematics is gaining control over the mathematics register so that one is able to talk like a mathematician (Pimm, 1991). For the first four years of schooling, it means that gaining control over the mathematics register in one's local language.

Ni Riordain & O` Donoghue (2008) argues that the source of difficulty with students in the learning of mathematics include syntax, semantics, and mathematics vocabulary such as numerator and denominator. The results of the study conducted by Ni Riordain & O` Donoghue (2008) found that students with poor mathematics vocabulary and register in English performed poorly.

Further to this, Morgan (1998) and Pimm (1991) explains that, while mathematics, when spoken, emerges in a natural language, when written, it makes varied use of a complex, rule-governed writing system mainly separate from that of the natural language into which it can be read. Such mathematical encoding includes symbol order, position, relative size and orientation (Pimm, 1991). Morgan (1998) calls this "writing system" as "mathematical academic writing" (p. 11). Which means that, teachers in a mathematics classroom have the duty of helping learners to write mathematically that is, using symbols in a correct order by using the local languages. One of the areas that teachers will have to safeguard is never to dilute the mathematics/mathematical language. Thus how does the teaching and learning of mathematics go in local languages? What are the implications in the development of the mathematical languages of the learners?

In most African countries such as Malawi, mathematical terminology in local languages has not yet been developed. Therefore even though the teachers use the local languages but when it

comes to mathematical terms, they are pronounced as English but the spellings is written using local syllabi. For example corner in Chichewa will be "kona". Considering that the language in education policy in Malawi encourages the use of local languages in lower classrooms, the implication is that mathematical language to be learnt is the mathematical language expressed in the local language. The mathematics, which include mathematical terms are carried and expressed in local languages rather than English. However, what actually happens in a classroom where the LoLT is the local language remains to be unknown. What are the implications to both teachers and learners? What are the challenges that they face? In line with the recommendations of GTZ (2005) how much has been achieved after 10 years in the teaching and learning of mathematics in local languages?

Complexity of mathematics teaching and learning

Teaching mathematics in a language that is not your home language is difficult since the teachers have the duty to teach two languages, the mathematical language and the LoLT (Adler, 2001). The implication of this statement is that teaching mathematics in local languages is not that difficult since the mathematics teacher will only have to deal with the mathematical language and not the LoLT. The mathematics that is being taught in schools has a well-developed language in the foreign languages as compared to mathematics in local languages. It is important to investigate, how simple is it to teach mathematics in local languages where the mathematical language is not well developed.

As indicated in the introduction, an analysis of classroom observations conducted in Tanzania and Malawi, revealed that there were problems in communication between teachers and learners in a classroom where the language, which was foreign to both, was used as LoLT (Alidou & Brock-Utne, 2005). Most learners did not grasp and develop the mathematics register, because it was presented in foreign languages. Would learners grasp and develop the mathematics register if it is taught in local languages.

Literature supports the fact that teaching mathematics is complex because of different reasons. For example just the mathematical language adds on to the complexity of teaching and learning mathematics in multilingual classroom in different ways. Mathematical language has certain language features, for example, that cannot be matched with other languages. Halliday (1975) gives an example that "four from six leaves two" when interpreted is "6 – 4 = 2". In addition, mathematical language includes everyday vocabulary that takes on a different meaning in mathematics; for example, words like set, point, table, and altogether (Halliday, 1975). Learners are expected to know and become familiar with this type of language, which they have to learn from the mathematics teachers in their classrooms. There is one advantage with this, which is the language of mathematics is well developed, how would one teach these concepts in a local language in which the mathematical language is not well developed?

Morgan (1998) and Pimm (1991) explains that, while mathematics, when spoken, emerges in a natural language, when written, it makes varied use of a complex, rule-governed writing system mainly separate from that of the natural language into which it can be read. Such mathematical encoding includes symbol order, position, relative size and orientation (Pimm, 1991). Morgan (1998) calls this "writing system" as "mathematical academic writing" (p. 11). Which means that, teachers in a mathematics classroom have the duty of helping their learners to write mathematically that is, using symbols in a correct order, so that they can become mathematically literate.

Furthermore, learners may attempt to read, write and understand the mathematical sentences in the same way that they read write and understand standard narrative text. Learners may try to translate word by word between mathematical concepts and, in most cases, in a linear translation. One-to-one linear translations are not always appropriate since the way some mathematical concepts are expressed in words differs in its order from the way the concept is expressed in symbols. For example, the number is five less than the number b, which the learner may mistakenly restate as $a = 5 – b$ when it should be $a = b – 5$ (Jarrett, 1999).

Moreover, mathematical concepts sometimes are made up of the relationship between two words, which are hard to understand and at the same time require the use of symbols in solving the problem. For example, phrases like 'all numbers greater/less than X'. In the context of mathematics, "symbols can help to show structure, allow routine manipulations to become automatic and make reflection possible, by putting thoughts that one has with so some stability, compactness and permanence, as objects which may be examined" (Pimm, 1991, p. 19). However, Pimm argues that the 'concreteness' of the symbols and the absence of obvious mathematical objects to act as referents can lead many pupils to believe that the symbols are the mathematical objects. The technique of

describing algorithms in terms of attributes of the symbols adds to the potential confusion. This shows the need for learners to be skilled in mathematical vocabulary. The discourse that these teachers have been exposed to is the English mathematical discourse and so what type of mathematical discourse is produced when they teach mathematics/mathematical concepts in local languages?

Apart from the need for learners to be skilled in mathematical vocabulary and the mathematical writing system, learners will also be required to know the logical connectives (Dawe, 1983) in mathematical language in local languages. Mathematical language is mostly linked with connectors such as if... then, if and only if, because, and either... or which signal relationships between parts of a mathematical text. These words signal similarity or contradiction, cause and effect, reason and result, chronological or logical sequence (Jarrett, 1999). These words also serve to link propositions in reasoned argument (Dawe, 1983). Dawe states that, knowledge of logical connectives is so important, more especially for achievement on a mathematical test. Therefore, Dawe argues that, the development of the ability to use logical connectives for reasoning and argument is an important task for mathematics and science teachers. Have you ever thought how this can be achieved in local languages especially African countries where the mathematical language is not yet developed? Thus the enormous job for the mathematics teachers is to help their learners develop the ability to be able to use and interpret these logical connectors in a local language in case of the first four years of schooling where the local language is a LoLT without diluting the mathematics. This means that the teacher should first of all interpret the mathematics into local languages on his/her own and then be able to teach. If the teachers were not exposed to these types of local languages where would they take the mathematical language in local languages? And what type of mathematical language do they produce when they are teaching.

As can be seen from the mathematical language alone, teachers have an enormous task in trying to get their learners to learn mathematics, thereby accomplishing their education objectives in a mathematics classroom. These challenges take on added significance in the context where the language of learning and teaching is not the home language of both the learners and teachers. It is assumed that most of the things mentioned in the preceding section are easily done if the LoLT is the home language of both the learners and the teachers, but is this true? In most African classrooms and Malawi in particular, the LoLT is English from grade five upwards, which makes the teaching of mathematics even harder, but is the teaching of mathematics in local languages easier? There are many issues that emerge as teachers teach mathematics in local languages and that should be of concern. One of the issues is how mathematics teachers can make mathematics more comprehensible to their learners' in local languages.

The Study

Since this study attempts to gain an in-depth understanding of the experience and developments associated with the teaching and learning of mathematics in local languages in primary schools, the study adopted a qualitative research approach whose purpose is to understand the social phenomena from the respondents and participants' perspective (Macmillan and Schumacher, 2006; Strauss and Corbin, 1998).

The sample in this study therefore included four primary mathematics teachers in one semi-urban primary school in Malawi and their learners. The teachers were selected purposefully (Patton, 1990) based on the criteria that they were teaching the lower classes that uses local languages as language of learning and teaching. Each mathematics teacher had Primary school teachers' certificate and had at least three years of teaching experience in lower primary school. They were also selected on the basis of their willingness to participate in the study. All the four mathematics teachers to be presented have Chichewa as their home languages and also almost all the learners came from the surrounding community where Chichewa is their local language.

Research Methods

The research methods employed in this study included pre-observation focus group discussions where we discussed the challenges being faced when teaching and learning mathematics in local languages, how they overcome those languages and the topics that they consider to be the most difficult topic to teach in local languages and why. The latter part was asked because it was observed previously that they were some topics that were relatively easy to teach in local languages

while some seemed to be difficult. After the focus group discussions we conducted classroom observations. Our observations focused on standard 3 and standard 4 and we also focused on the topics that were mentioned as difficult to teach in Chichewa. All the interviews were tape recorded and the classroom observations were video recorded.

Grounded Theory Analysis

In this particular study, we have used grounded theory analysis in analyzing the data collected. Grounded Theory analysis is described as a qualitative research approach that uses a systematic set of procedures to develop an inductively derived grounded theory about a phenomenon (Macmillan and Schumacher, 2006; Strauss and Corbin,1998) The author explains that the primary objective of grounded theory, then, is to expand upon an explanation of a phenomenon by identifying the key elements of that phenomenon, and then categorizing the relationships of those elements to the context and process of the experiment. In other words, the goal is to go from the general to the specific without losing sight of what makes the subject of a study unique.

In this grounded theory method and this study in particular, the explanations given in the next sections are developed from the data, rather than from any theory. The method of study is essentially based on three elements: concepts, categories and propositions (Macmillan and Schumacher, 2006). However, concepts are the key elements of analysis since the theory is developed from the conceptualization of data, rather than the actual data (Macmillan and Schumacher, 2006)
Furthermore, the data analysis in this study proceeded both during and after data collection. The first step involved transcribing all interviews. This task was time consuming and very difficult. In our transcription, we aimed for consistency while acknowledging the analytical process that transcription involves and the challenges inherent in attempting to produce accurate re-presentation of taped conversations (Cohen, Manion and Morrison, 2005).

Findings

The Type of Mathematical Discourse Produced

This article highlights the type of mathematical discourse that is produced when the language of teaching and learning is local languages in primary schools. When we observed the mathematics teaching and learning in local languages, there were a number of issues that came to the fore. Firstly it was observed that both students and teachers were able to communicate freely.

However, even though the teachers were able to communicate freely in the mathematics classroom, it was discovered that there were some major challenges that both teachers and students faced regarding the mathematical discourse and mathematical concepts. The findings to be presented here come from the class where the teacher was teaching volume to standard 3 learners. She started with defining what volume is. From her definition there were three "concepts" that emerged as shown in Extract 1.

The teacher brought the teaching items in the class and put them on the table where everybody could see.

Extract 1:

Teacher: *Chantenga malo akulu pamenepa ndi chiti .....* [What has taken a lot of space?]

In this extract, the teacher was referring to volume as "the thing that has taken a lot of space". Thus volume is an object. Minutes later, she said

Extract 2:

Teacher: *Lero tiphunzira volume, mulingo, wa chithu chomwe chikutenga mmalo akulu kuti apangidwe cover, ndiye tathauzo la volume ndi mulingo wachithu chilichonse chomwe chatenga mmalo ambiri, tisanapitilire alipo ali ndi funso?* [Today we are going to learn about volume, measurement of the thing that has taken a lot of space to cover, that is, the meaning of volume is the measurement of things that has taken a lot of space, before we continue anyone with a question?]

Students: *Quite*

Teacher: *Chabwino tati volume ndi chani?* [Okay, what did we say is volume?]

Students: *Chithu chomwe chatenga malo akulu* [a thing that has taken a lot of space]

As she continued to teach, she gave a number of examples that were related explaining what volume is. And minutes later the teacher continues to say:

Extract 3:

Teacher: *Mwala uyo ndi uwu kusiyana mulingo womwe watenga mmalo ambiri ndi uti, mulingo womwe ukusiyanawo ndi omwe tikuutcha kuti volume* [Between these two stones, considering the difference in measurement that has taken a lot of space, the difference in measurement is what we are calling volume]

Considering extracts 1 to 3, there are three different concepts that are coming out. Firstly there is an issue of occupying a lot of space, which is the definition of area, thus volume is defined as "area concept". Then the same volume is referred to as "the object" that has taken a lot of space. Thirdly, is that, volume is "measurement". Also, volume is referred to as "the difference between the two objects that are similar". In these definitions the word volume takes on three different meanings. Firstly is confused with area, secondly confused with measurement and thirdly confused with the difference between two areas.

When we checked with the textbooks and the teacher's guide, the concept of volume is given in English. Also in Chichewa, most of the thinking is done in a two dimensional space. As a result, it is easier to explain what area is but very difficult to explain Volume in a three dimensional space in Chichewa.

The mathematical vocabulary in Chichewa in Malawi is not well developed; as a result most of the mathematical terms are left as they are when teaching in local languages. However, in this instance, it could have been possible to leave volume as it is, but the question is how one would explain what it is in the local language. The implication here is that a mathematics teacher is supposed to translate the mathematical concept expressed in English, to mathematical concept expressed in a local language. The end result is the distortion of the mathematical concept itself hence the distortion of understanding of the mathematical discourse by the students.

The assumption in the textbooks is that since everybody speaks Chichewa then it would be easy for the teacher to translate the English Mathematical concepts into a local language without changing the meaning, which is not the case. In other words instead of enhancing the teaching and learning of mathematics, the use of local languages as LoLT can be a hindrance to the teaching and learning of mathematics.

When it was cross checked with the teacher's guide and student's main text, it was also found that there are no explanations given to what volume is in local languages. This particular teacher has been exposed to the definitions of volume in English. Also as explained in Chitera (2010, 2012), teacher training institutions model the teaching of mathematics in English and yet the teachers who are being trained will go and teach mathematics in local languages.

To show that she was sure of her interpretations, she gave the following class work in extract 4:

Extract 4:

Teacher: *Lembani chinthu chomwe chatenga malo ambiri.* [write the object that has taken a lot of space]

Teacher: *Chachiwiri chatenga malo akulu ndi chani sopo ndi machesi* [the second object that has taken a lot of space between soap and matches]

Students: *Sopo* [Soap]

Teacher: *Nanga papaya ndi tomato* [what about between pawpaw and tomato]

Students: *Papaya* [pawpaw]

Teacher: *Nanga Foni ndi Wailesi .....* [What about phone and wireless]

Students: *Wailesi* [wireless]

Teacher: *Lero taphunzira chani* [what have we learnt today]

Students: Volume

Teacher: *Eya, chithu chomwe chatenga malo ambiri* [yes, the object that has taken a lot of space]

From this extract the teacher concludes that volume is the object that has taken a lot of space. The observation from this lesson stems from the fact that there is no explanation of the concept under discussion in local languages. When we followed up with this particular teacher, it was noted that she has never come across the concept of volume in local languages, not in the books, not in any informal charting and even in the teachers training college. It should also be noted that to differentiate volume from area in Chichewa is not an easy task that can be left to the teacher alone.

Dilemma between the informal and formal mathematical language in local languages

Apart from the distortion of the mathematical discourse in a classroom where local languages are used as LoLT, we also observed that there were dilemmas between the informal and formal mathematical language. This was seen when the teacher was teaching how to characterize different mathematical objects. In this particular class the teacher brought a number of items in the class and students were supposed to differentiate the items and name them according to their characteristics. This is shown in extract 5.

Extract 5.

Teacher: *lero tiphunzira zithu zosiyanasiyana, tinene mmene ifeyo timazionera zithu zathu kukhala zosiyana siyana, ineyo pabolodipa ndalembe, ndanjambula zithu zosiyanasiyana, kodi ichi, ichi mmene chikuonekeramu chikuoneka kuti ndichotani maonekedwe ake [*today we will learn different things, we are supposed to describe how these objects look like, on this black board , I have drawn different objects, what about this one, how does it look like?*]*

Student 5: *Cha godya [*has corners*]*

Teacher: *cha makona, akuti chamakona kapena kuti changodya, eya makonawa alipo folo, tiyeni tiwerengeni [*has corners, he says it has corners, yes there are four corners, lets count them*]*

Students: *1, 2, 3, 4*

Teacher: *Folo, chamakona 4 kapena kuti changodya folo folo, mmene ilili kalasi inonso ilindimakona folo, tamvana eti [*four, has four corners, just like this class, it has four corners, are we clear?*]*

Extract 5 shows that there are two technical terms in Chichewa that can be used to mean "corner". The first one is 'godya' as the students said and the second one 'makona' as the teacher said. In her response, the teacher revoices the learners answer with 'makona' and then repeats this word and then for the third time she revoices but with the term that the student used 'chagodya'.

This extract reveals how the teacher struggles to decide which mathematical technical term to use between 'Chagodya" and "makona" as seen in the last sentence of extract 5. Both terms have been used again.

Similarly, in Extract 6 the teacher asked the learner to describe a different object. This object was round (a ball).

Extract 6

Teacher: *Chabwino, tili pachiwiri, ndani angatiuze [*Okay we are at the second position, who can tell us?*]*

Student 9: *Chandendeya [*It is round*]*

Teacher: *akuti chozungulira, tiyeni tonse tinene chozungulira[*he says it is round, lets all say, it is round*]*

Students: *chozungulira [*it is round*]*

Teacher: *tikanena kuti chozungulira ndi ndendeya ndichimodzimodzi eti [*when we say corners and corners, it means the same thing *]*

Students: *eeh [*yes*]*

When the teacher asked the students to describe the second object, the student responded by using the term "Chandendeya". The teacher revoices the answer but using a different name again. This time she says "chozungulira". She then asks the students to repeat after her the word "chozungulira" of which

they did. However, in the last line of the extract 6 she use two terms, 'chozungulira' and 'chandendeya'.
Another observation is that in both extracts 5 and 6, the term that the students gave was revoiced at the end of the extracts and not immediately.
Later own the teacher told the student that they should be using one term as seen in extract 7

Extract 7

Teacher: *tiyeni tigwiritse Chichewa chimodzi, ndichozungulira [*lets use one Chichewa word, it is round*]*

Extract 7 the teacher indicates that she would want to use one mathematical technical term. The question is which term would she choose and why? The term that she chooses is "Chozungulira" over "chandendeya" which means round.
When the teacher was asked why, she responded in this way.

Extract 8

Teacher: *Mawu woti Chandendeya ndi mawu omwe ali mu buku, koma ndi mawu oti ana samawadziwa ndiponso sagwiritsidwa tchito kawiri kawiri, koma mawu oti makona kapena chozungulira aliyense amawadziwa. Chimodzimodzi 'godya'. Ana amadziwa kuti "Chamakona" osati "godya"[*the term chandendeya is in the book, but it's a word that students are not familiar with, they do not use the word frequently, but the term makona or chozungulira, everybody knows them, the same thing with the term godya, students know makona not godya *]*

The teacher explains that the other terms are terms used in books but are not common and therefore she prefers to use common terms since the students are already familiar with these terms. However, later she was seen using both terms again as in extract 9.

Extract 9

Teacher: *Chozungulira pansi ndi pamwamba, chabwino, takambirana kuti maonekedwe a zithu, zina zimakhala ndi* ***makona folo kapena za godya folo****, kapena zagodya zochulukirapo, koma lero tiphunzira za godya folo, komanso tikuphunzira china* ***cha ndendeya pansi ndi pamwamba ngati cup, tikuphunziranso china chimene changokhala chozungulira****, tamvana eti, eya chabwino ndikufuna kuti inuyo mukhale mmagulu koma musanakhale mundimvetserendalemba zithu zosiyanasiyana, magulunso osiyana siyana, mwachitsanzo[*It is round both below and above, okay we have discussed that, somethings have four corners, or more corners, but today we have learnt the objects with four corners, also we have learnt of objects that are round below and on top like a cup, and the other objects which are just round ….*]*

Discussion and Summary

The discussion of this paper focuses on three issues as presented below.

Mathematics teaching still complex in local languages

The discussion in this article reveals that teaching and learning of mathematics in local languages is as complex as teaching and learning mathematics in foreign languages. It is well known that mathematical discourse is not well-developed in most African languages. This study has shown that teaching mathematics using the language which is not well-developed takes away the confidence of teachers. As a result, the teacher cantered approach still dominates the mathematics classrooms

even though both teachers and students can communicate freely. Both chorus answers, use of one word and procedural discourse is also dominant.

Thus, even though the LoLT is the local language, teachers tended to talk more than students. One of the reasons of introducing the local languages was that teachers were using teacher centered approaches because the language of teaching and learning was English, however, even in the class where local languages is being used as LoLT, this approach still dominate. The implication here is that introducing the local languages, when the mathematical language is not developed, does not make the teaching and learning of mathematics easier. There is more rather than just the LoLT. Further, due to lack of technical terms and proper mathematical discourse in the local languages, both teachers and books tend to use a lot of distracters in the lessons. The context does not enrich the development of the mathematical discourse in both the teachers and students. In this way students attention is drawn away from the concept by the context being used.

In the literature it was noted that the use of colonial/foreign languages makes learners not to participate, it is also true that lack of explanations of mathematical concepts in local languages limit both the students and teachers interaction.

Distortion of mathematical Discourse

This study has shown that mathematical discourse and concepts produced when teaching and learning in local language is distorted when the discourse and concepts are not well-developed in local languages. The examples that have been shown in this paper of volume support this. Being fluent in the language of learning and teaching does not mean that one will be able to explain the concepts without distorting them. We have noted that books and policy makers assume that when one is fluent in the local language then the teaching of mathematics would be straight forward. However, this study has shown that this is not the case. This indicates that being fluent in the LoLT and being able to teach mathematics correctly are different things that need to be intertwined skilfully in order not to distort the mathematics.

Thus we would like to argue that teaching mathematics in local languages is not as easy as it is assumed more especially if the mathematical discourse is not well developed. The major thing that makes it difficult is the lack of mathematical technical terms and definitions. In trying to explain the mathematical term in local language, it is noted that the teachers wander a lot in their explanations and in the process the concept that comes out is different from the actual concept that is to be taught as in the case of graphs and volume.

Tensions between formal and informal mathematical language

This study has also shown that there are tensions between formal and informal mathematical language in a classroom where LoLT is the local language. It has been discussed that in textbooks used by teachers, the words that are used there, referred to as “formal mathematical language” are uncommon to both teachers and students. As a result teachers were in dilemma between what words to use between the common ones referred to as informal versus the formal. It was seen that teachers preferred the informal terms rather than the formal one since students were not familiar with them. However, even though they preferred the informal terms, they were not sure which ones to use as they still wandered between the two terms being used.

Summary

In summary, this study shows that there is more to the teaching and learning of mathematics rather than the introduction of local languages as a language of learning and teaching in a classroom. It seems to be more complicated to teach mathematical concepts in local languages. Concepts get distorted. The argument here is that using local language as learning and teaching tool is even more complicated than using English. It needs to have supporting elements in place in order for it to work. It should be noted here that we are not against the use of local languages; rather as mathematics teachers we have the duty to safeguard the mathematics discourse so that it is not distorted.

We therefore recommend that there is need for more investment beyond the introduction of local languages as LoLT so that we can achieve the desired results.

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